COMB-LOCKED CAVITY-ASSISTED DOUBLE RESONANCE SPECTROSCOPY (CLCA-DR)

JIN WANG, CHANGLE HU, AN-WEN LIU, CUNFENG CHENG, TIAN-PENG HUA, YU ROBERT SUN, YAN TAN, SHUI-MING HU, *Hefei National Laboratory for Physical Science at Microscale, University of Science and Technology of China, Hefei, China*.

Double resonance spectroscopy has been frequently applied in state-selective excitation and to reach energy levels forbidden to single-photon transition. Due to the low cross section of two-photon transitions, usually high-power pulsed lasers are needed, which prevent high-precision measurements. Optical resonant cavity can be used to enhance the effective path length and also the laser power inside the cavity. By simultaneously locking two continuous-wave lasers with one high-finesse cavity, we established comb-locked cavity-assisted double resonance (CLCA-DR) spectroscopy of molecules. Doppler-free two-photon CLCA-DR spectroscopy of the monoxide carbon molecule were recorded by using two diode lasers with milli-watts power in the 1.5μm region. Three different types of double resonance: Λ-, V- and ladder-type, were demonstrated. By comparison to the energy difference obtained in previous high-precision single-photon spectroscopy using comb-locked cavity ring-down spectroscopy [1], we confirmed that the CLCA-DR measurement can also achieve an accuracy of kHz level. The energy of the highly excited state of $^{12}C^{16}O$, V=6, J=9 was determined to be kHz level (δE/E is about 10^{-11}) by a "ladder-type" double resonance measurement using the V=3, J=10 level as the intermediate state.

Keywords: cavity assisted; double resonance; Doppler free;

Reference: [1] Wang, J. et al., J. Chem. Phys. 2017, 147: 091103.